

**REMARKS**

Reconsideration of the application in light of the above amendment and the following remarks is respectfully requested.

**Status of the Claims**

Claim 1 has been amended. Support for the amendment can be found in the Specification on page 19, lines 15-20 and in Table 1. Claims 11-13 have been added. Support for new claims 11-13 can be found in the Specification on page 12, lines 7-12; page 16, lines 18-21; and in Table 1.

Claims 1-13 are pending in the application. No new matter has been added by way of amendments or additions.

**Objections to the Drawings**

The Examiner has objected to Figure 4 for not being labeled as "Prior Art." Applicant has amended Figure 4 to include the "Prior Art" label and have attached a replacement drawing sheet as **Attachment A**. Applicants respectfully request withdrawal of the objection.

**Rejection under 35 U.S.C. §112**

Claims 1-10 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. The Examiner contends that an understanding of theoretical density is critical to the making of the invention recited in claims 1-10, and further contends that the Specification lacks such a disclosure. Applicants respectfully traverse the rejection.

The Examiner states:

An understanding of theoretical density is critical to the making of the invention because the limits set forth in claim 1 require specific percentages of theoretical densities for the invention. However, an understanding of the usage of theoretical density is not described within the specification. (Detailed Action, pages 2-3.)

Applicants submit that an understanding of theoretical density is not critical in making the invention recited in claims 1-10. Contrary to the Examiner's position, claim 1 does not require specific percentages of theoretical densities for the solder layer. In contrast, claim 1 requires that the relative density of the solder layer be a specific percentage of the calculated theoretical density of the solder layer.

Furthermore, Applicants submit that the term "theoretical density" is well-known to those skilled in the art. For example, U.S. Patent No. 4,237,085 to Smoak (**Attachment B**) and U.S. Patent Publication No. 2004/0238795 to Duan et al. ("Duan") (**Attachment C**) reference "theoretical density" without defining the term. See, Duan, claims 14-19, paragraphs 0012-0013, 0028, 0032, and 0037; and Duan, claims 1-2, col. 1, lines 55-61, col. 2, lines 11-16, col. 4, lines 39-41, Tables 1 and 2, and Abstract. Additionally, U.S. Patent Publication No. 2004/0201137 to Zhan et al. ("Zhan") (**Attachment D**) states that "the theoretical density and means of calculating the theoretical density are well known to those skilled in the art." See, Zhan, paragraph 0021.

In view of the above remarks, Applicants submit that the Specification contains sufficient disclosure to enable one skilled in the art to make or use the invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

**Rejection under 35 U.S.C. §102**

Claims 1-5, 7-8, and 10 stand rejected under 35 U.S.C. §102(b) as being anticipated by the Applicants' Acknowledged Prior Art ("AAPA"). The Examiner contends that "as long as there is a solder layer containing one of the following: gold-tin alloy, silver-tin alloy or lead-tin alloy, that the [respective] solder layer will have the required theoretical density because it is comprised of the same material and under the same conditions the material should behave in the same manner." (Detailed Action, pages 3-4.) Applicants respectfully traverse the rejection.

Applicants submit that the theoretical density of a solder layer is calculated based upon the mass ratio of the metals used to form the solder layer<sup>1</sup>. Furthermore, Applicants submit that the AAPA does not disclose forming the solder layer from at least two metals in a specific mass ratio to form the gold-tin alloy, silver-tin alloy, or lead-tin alloy. It is impossible to calculate the theoretical density of the AAPA's solder layer because the AAPA does not disclose the ratios in which the two metals are combined. Therefore, one cannot make a comparison of the relative density of the AAPA's solder layer to the theoretical density of the AAPA's solder layer, since the theoretical density of the AAPA's solder layer is unknown. Thus, the AAPA does not disclose each and every element recited in independent claim 1.

Notwithstanding the above remarks, Applicants have amended claim 1 to recite "a solder layer comprising at least a first metal and a second metal in a specific mass ratio . . . wherein the relative density of said solder layer before melting is at least 50% and no more than 99.9% of the theoretical density of said solder layer." (emphasis added). As discussed above, the AAPA does not disclose combining "a first metal and a second metal in a specific mass ratio," as recited in

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<sup>1</sup> The American Society for Testing and Materials Standard ("ASTM") defines theoretical density as: The ratio of the mass of a collection of discrete pieces of solid material to the sum of the volumes of said pieces, the solid material having an ideal regular arrangement at the atomic level. See, Attachment E, page 9.

claim 1. Therefore, since it is impossible to calculate the theoretical density of the AAPA's solder layer, it is likewise impossible for the AAPA to disclose or suggest that "the relative density of said solder layer before melting is at least 50% and no more than 99.9% of the theoretical density of said solder layer," as recited in independent claim 1.

In view of the above remarks, Applicants submit that the AAPA does not disclose each and every element recited in claim 1. Therefore, the AAPA does not anticipate the invention recited in claim 1.

Claims 2-5, 7-8, and 10 depend from claim 1. Applicants submit that claims 2-5, 7-8, and 10 are patentable for at least the same reasons as discussed above with respect to claim 1. Applicants respectfully request reconsideration and withdrawal of the rejection.

### **Rejection Under 35 U.S.C. §103**

Claim 6 stands rejected under 35 U.S.C. §103(a) as being unpatentable over the AAPA in view of U.S. Patent No. 6,521,477 to Gooch et al. ("Gooch"). The Examiner acknowledges that the AAPA does not disclose that the solder adhesion layer 107 contains a noble metal layer disposed on the solder layer side and containing at least one of gold, platinum, and palladium, and a transition element layer disposed on the electrode layer side containing at least one of titanium, vanadium, chromium, zirconium, and niobium. However, the Examiner relies on Gooch as disclosing a solder layer 40 that is deposited on a lid solder adhesion surface 38 comprised of a first layer of titanium followed by a middle layer of palladium and an outer layer of gold. See, Gooch, col. 6, lines 21-27; col. 6, lines 56-62; and Figure 7. The Examiner contends that it would have been obvious for one of ordinary skill in the art at the time of the

invention to combine the AAPA with Gooch to achieve the invention recited in claim 6. Applicants respectfully traverse the rejection.

Applicants submit that Gooch neither discloses nor suggests the features demonstrated to be missing from the AAPA with respect to claim 1. Claim 6 depends from claim 1. Therefore, the combination of the AAPA and Gooch does not disclose each and every feature recited in claim 6. Applicants respectfully request reconsideration and withdrawal of the rejection.

Claim 9 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the AAPA in view of U.S. Patent No. 4,585,706 to Takeda et al. (“Takeda”). The Examiner acknowledges that the AAPA does not disclose that the submount substrate contains sintered aluminum nitride or sintered alumina. However, the Examiner relies on Takeda as disclosing a silicon semiconductor device 20 using an insulating substrate that comprises sintered aluminum nitride. See, Takeda, claim 1 and Figure 6. The Examiner contends that it would have been obvious for one of ordinary skill in the art at the time of the invention to combine the APA with Takeda to achieve the invention recited in claim 9. Applicants respectfully traverse the rejection.

Applicants submit that Takeda neither discloses nor suggests the features demonstrated to be missing from the AAPA with respect to claim 1. Claim 9 depends from claim 1. Therefore, the combination of the AAPA and Takeda does not disclose each and every feature recited in claim 9. Applicants respectfully request reconsideration and withdrawal of the rejection.

#### **Added Claims**

New claims 11 and 12 are directed to the specific mass ratios of the two metals forming the solder layer. Support for new claims 11 and 12 can be found in the Specification on page 12,

lines 7-12 and in Table 1. As new claims 11 and 12 are dependent from claim 1, Applicants submit that new claims 11 and 12 are patentable for at least the same reasons as discussed above with respect to claim 1.

New independent claim 13 recites that the solder layer is formed using a solder film-formation rate of at least 1.3 nm/sec. Support for new claim 13 can be found in the Specification on page 16, lines 18-21. Applicant submits that new claim 13 recites at least the features of claim 1, and is therefore patentable over the art of record.

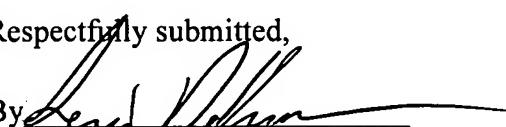
### CONCLUSION

Each and every point raised in the Office Action mailed January 10, 2006 has been addressed on the basis of the above amendments and remarks. In view of the foregoing it is believed that claims 1-13 are in condition for allowance and it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

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Respectfully submitted,

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